

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Applicant : Konstantin Holdermann
Application No. : To be assigned
Filed : Herewith
Title : ETCHING SOLUTION FOR WET CHEMICAL PYRAMIDAL
TEXTURE ETCHING OF SILICON SURFACES
Parent Application
No. : 09/272,022
Grp./Div. :
Examiner : To be determined
Prior Application
Examiner: : Shamim Ahmed
Docket No. : S969/MJM/47585

PRELIMINARY REMARKS

Assistant Commissioner for Patents
Washington, D.C. 20231

Post Office Box 7068
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March 5, 2002

Commissioner:

Please examine the above-identified continuation application in view of the remarks provided below.

REMARKS

Claims 17-28 of parent application serial no. 09/272,022 have been re-written as claims 1-12, respectively, in the subject application, and amended as discussed below.

Claim Amendments based on the Rejection under the Church, et al. Reference

Independent claims 17 and 23 were rejected in the Office action dated June 29, 2001 for parent application serial no. 09/272,022, under 35 U.S.C. §102(b) as being anticipated by Church, et al. (U.S.P. 3,909,325), hereinafter "Church". The claim rejections in the parent

application are obviated in the subject application based on the claim amendments and reasons set forth below.

Claims 17 and 23 have been re-written as independent claims 1 and 7, respectively, of the subject application, and have each been amended to now recite the feature that the etching solution is a "free-standing" etching solution. The cited reference of Church does not disclose a "free-standing" etching solution which includes both isopropanol (IPA) and ethylene glycol. Rather, Church teaches a pre-treatment step using isopropyl alcohol (IPA) followed by an etching step in which the etching solution includes ethylene glycol and not IPA. (Isopropanol and isopropyl alcohol are one and the same and may also be referred to as IPA.) The Office action states that both IPA and ethylene glycol, therefore, would be present simultaneously during the etching process. Since IPA is only part of the pre-treatment, however, applicants respectfully submit that the IPA is simply not a component of the "etching solution", and that Church does not teach or suggest a "free-standing" etching solution that includes both isopropanol and ethylene glycol. As such, each of independent claims 1 and 7 have been re-written to recite that the etching solution is a "free-standing" etching solution that contains both isopropanol and ethylene glycol.

In a telephonic examiner interview with Examiner Shamin Ahmed which took place on September 12, 2001, the Examiner generally agreed that the addition of the feature of "free-standing" to describe the etching solution distinguishes the claims from the cited reference of Church and overcomes the rejection under 35 U.S.C. §102(b) based on the Church reference. As such, re-written claims 1 and 7 include features which distinguish them from the Church reference. Claims 2-6 and 8-12 depend from claims 1 and 7, respectively, and therefore, the Church et al. rejection under 35 U.S.C. §102(b) is obviated with respect to re-written claims 1-12 of the subject application.

Claim Amendments based on the Rejection under the Bailey, et al. Reference

In the Office action for parent application serial no. 09/272,022 dated June 29, 2001, claims 17-28 (now claims 1-12 in the subject application) were also rejected under 35 U.S.C. §103(a) as being unpatentable over Bailey et al. (USP 4,137,123), hereinafter "Bailey", in view of applicant's admission. The claim rejections in the parent application are obviated in the subject application for reasons set forth below.

Independent claims 1 and 7 each recite an etching solution that includes both isopropanol and ethylene glycol. In the Office action, the Examiner concedes that Bailey does not teach or suggest combining isopropanol and ethylene glycol together. The Office action then states that it would have been obvious to one of ordinary skill in the art to combine the components together, because both of them are functionally equivalent and also used for the same purpose.

In response to applicant's previously advanced argument that it would not be obvious to combine isopropanol and ethylene glycol (Applicant's response of April 20, 2001), the subject Office action responds that "it is prima facie obvious to combine two compositions each taught by the prior art to be useful for the same purpose, in order to form a third composition which is to be used for the very same purpose." In support of this contention, the Office action cites the case of In Re Kerkhoven, 205 USPQ 1069, 1072 in paragraph 7, Response to Amendment.

Applicant first respectfully points out that in the field of silicon etching, and in particular in the field of pyramidal silicon etching, ethylene glycol and isopropanol are **NOT** functionally equivalent when used as components of the etching solution, and they are therefore **NOT** used for the same purpose. Furthermore, the cited reference of Bailey does not teach anything about the properties of isopropyl alcohol or ethylene glycol as etching solution components, much less that they are functionally equivalent. Bailey merely **lists** these constituents in the alternative as solution additives. Bailey never teaches or suggests the function of either of these constituents, much less the function of each of them, and therefore does not and cannot teach or suggest that they are functionally equivalent.

In fact, applicant respectfully points out that, as additives in a silicon etching solution, isopropanol and ethylene glycol are not functionally equivalent, nor are they used for the same purpose:

* **Isopropanol** is included in the etching solution to enable the solution to be immediately useable for texture etching. Isopropanol tends to produce large pyramids and includes the disadvantage that it has a high rate of evaporation, which impairs the reproducibility of a uniform pyramidal texture.

* In contrast, **ethylene glycol** is added to a silicon etching solution to produce small pyramids having a height of less than or equal to 2 microns. Ethylene glycol requires the preceding dissolution of the silicon surface, however, and unlike isopropanol, does not yield an etching solution that is immediately useable after formation.

The only apparent similarity between isopropanol and ethylene glycol is that they are both alcohols in the generic sense. There is no teaching or suggestion that they are functionally equivalent or useful for the same purpose in any application, much less as etching solution components for pyramidal silicon texture etching, where it is demonstrated that they are functionally distinguished. As such, the rejection based on the obviousness of combining two compositions each taught by the prior art to be useful for the same purpose in order to form a third composition which is to be used for the very same purpose, is obviated with respect to re-written independent claims 1 and 7.

Even if one were nonetheless to consider isopropanol and ethylene glycol to be functionally equivalent, the desirable and **unexpected and superior results** produced by combining the two components overcomes any prima facie rejection based on obviousness. By combining both isopropanol and ethylene glycol, an etching solution is produced that is immediately usable, does not evaporate too quickly, and produces pyramids of sufficiently small height. An etching process can therefore be performed promptly after the etching solution is formed. The etching results of the product etching solution is also relatively insensitive to the exact composition of the etching solution. Further advantages include good reproducibility of the etching results, and since the solution is not based upon isopropanol alone, a lower evaporation rate is achieved, meaning that solution replacement is required less frequently.

This data/results offered by the applicant are evidence of the unexpected superiority of the claimed etching solution. With regard to the cited case of In re Kerkhoven, 205 USPQ 1069, applicant respectfully submits that the Kerkhoven case is limited to the facts in which claimed features that were used simultaneously, **are** useful for the same purpose and that the dicta of the Kerkhoven case is therefore not applicable to the present application because isopropanol and ethylene glycol are not used for the same purpose when used in the

aforementioned application. Furthermore, the court in *In re Kerkhoven* based its holding of non-patentability on the basis that "The comparative test data offered by applicant as evidence of the superiority of this claimed method does not rebut the prima facie case of obviousness *because it is not commensurate in scope with the claims.*"

In contrast, in the present application, the superiority of the present solution is evidenced by the results of combining isopropanol and ethylene glycol, both of which are specifically included in independent claims 1 and 7. Therefore, even supposing that isopropanol and ethylene glycol were functionally equivalent, the **unexpected and superior results** produced by mixing the two components, would overcome any prima facie case of obviousness because the data/results evidencing the superiority of the etching solution are commensurate in scope with independent claims 1 and 7.

In summary then, the obviousness rejection which the Office Action supports by relying on the *In re Kerkhoven* teaching, is neither on point nor applicable with respect to subject claims 1 and 7 because 1) isopropanol and ethylene glycol are not functionally equivalent and 2) even if they were functionally equivalent, the evidence of the unexpected superiority of their combination rebuts any case of obviousness since such superiority is based on their combination that is commensurate in scope with independent claims 1 and 7.

For the foregoing reasons, each of independent claims 1 and 7 is distinguished from the cited reference of Bailey under any of the obviousness arguments advanced in the Office Action with respect to claims 17-28.


In the parent application, claims 22 and 28 were rejected under Bailey in view of applicant's admission. However, the applicant's admission relates to mixing aqueous alkaline ethylene glycol with oxygen and therefore does not make up for the stated deficiencies of Bailey. Claims 1 and 7 are therefore distinguished from Bailey in view of the applicant's admission. Claims 22 and 28 are now re-written as claims 6 and 12 in the subject application. Since re-written claims 2-6 and 8-12 depend from rewritten claims 1 and 7, respectively, they are each distinguished from Bailey in view of applicant's admission. Therefore the rejection in the parent application, of claims 17-28, under 35 U.S.C. §103(a) as being unpatentable over Bailey in view of applicant's admission, is therefore obviated with respect to re-written claims 1-12 of the subject application.

CONCLUSION

For the foregoing reasons, each of re-written claims 1-12 is distinguished from the art of record. The application is therefore in condition for allowance, which action is respectfully requested.

Respectfully submitted,

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